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SPEIFICATION

1. Title of the Invention

METHOD FOR MANUFACTURING A BALL

2. WHAT IS CLAIMED IS

1. Method for manufacturing a ball comprising steps of:

expanding a spherical body made of rubber by introducing air
within said spherical body; and

bonding a synthetic resin leather cut piece on a surface of
said spherical body, wherein said cut piece is mainly made of
thermoplastic resin, and wherein said spherical body is covered with
said cut piece;

characterized in that said cut piece is three-dimensionally
formed along said surface of said spherical body in such a manner as to
have a spherical shape by a piece of mold for subjecting said cut piece to
heat and pressure, said piece of mold comprising an upper mold and a
lower mold, and said cut piece is compressed in such a manner that a
thickness of marginal edge of said cut piece increases as a distance from

a circumference of said cut piece becomes longer.

2. The method of claim 1, wherein said cut piece is compressed by said piece of mold for subjecting said cut piece to heat and pressure, in such a manner that said cut piece is divided into plural regions by borders, said borders are compressed by a piece of mold for subjecting said cut piece to heat and pressure so that a thickness of borders are reduced, whereby said plural regions can be seen like a plurality of independent cut pieces connected to each other through said border a piece of mold for subjecting said cut piece to heat and pressure.

3. The method of any one of claims 1 and 2, wherein said piece of mold for subjecting said cut piece to heat and pressure is a high frequency electrode mold.

4. The method of claim 3, wherein said high frequency electrode mold includes a cutting means for cutting said synthetic resin leather cut piece.

5. The method of any one of claims 1, 2, 3 and 4, wherein said step of bonding a synthetic resin leather cut piece on a surface of said spherical body is performed by arranging said synthetic resin leather cut piece on an inner surface of a recess engaged with said spherical body, wherein said recess is formed in a bonding mold; applying adhesive agent to at least either of an inner surface of said cut piece and the surface of said spherical body; and accommodating said spherical body within said recess formed in said bonding mold where the cut piece is

arranged.

3. Detailed Description of the Invention

The present invention relates to the improvements of method for manufacturing a ball used for volleyball, soccer, rugby and the like. More particularly, it relates to the improvements of method for manufacturing the ball comprising steps of expanding a spherical body made of rubber by introducing air within said spherical body; and bonding a synthetic resin leather cut piece on a surface of said spherical body, wherein said cut piece is mainly made of thermoplastic resin, and wherein said spherical body is covered with said cut piece.

In the conventional method for manufacturing the ball mentioned above, even if synthetic resin leather mainly made of thermoplastic resin is employed as a leather for covering the surface of the ball, the same method as employed in the method for manufacturing the ball where natural leather is covered on the surface of the ball. That is, the conventional method includes the steps of cutting a synthetic resin leather sheet by means of press punching or the like to obtain cut pieces having a pentagonal shape, hexagonal shape or elliptic shape where the circumference is curved, finishing a back surface of the circumferentially marginal edge of the cut pieces using a knife or the like as shown by reference symbol *e* in Fig. 1 or Fig. 2, applying an adhesive agent to the back surface of the cut pieces, arranging the cut pieces on a surface of a spherical body made of rubber, and bonding the cut pieces to the surface of the spherical body. According to the conventional method, it is particularly required to carefully urge the circumferentially marginal edge of the cut pieces having a reduced thickness against the

surface of the spherical body using a lancet or like for the purpose of perfect adhesive bonding on the circumferentially marginal edge.

In the conventional manufacturing method as mentioned above, there are many problems as follows:

(1) it is very troublesome work to finish the circumferentially marginal edge;

(2) the strength of the ball is lowered on the borders between the cut pieces circumferential marginal edge, because the strength of the circumferentially marginal edge is reduced due to the fact that the circumferentially marginal edge is finished;

(3) at the same time the performance of the ball to be actually used is rather varied, that is, the ball is so softly hit against the human body when compared with conventionally used ball where the spherical body is covered with plural cut pieces made of leather sewn together;

(4) less number of the cut pieces having a greater area cannot be covered on the surface of the ball, because the planar cut pieces are spherically formed by bonding them to the surface of the ball;

(5) the bonding step is difficult to be mechanically performed, for that reason, bonding the cut pieces to the surface of the ball is troublesome; and

(6) even if the pentagonal or hexagonal shaped cut pieces are employed, any border between the cut pieces cannot be located along a great circle on the ball without curving the sides of the cut pieces as shown in Fig. 2, so that manufacturing cost is increased.

It is required to make the circumferentially marginal edge of the cut pieces thinner not only for preventing the circumferentially marginal edge of the cut pieces from peeling to outwardly protrude, but

also for attain the performance to be actually used.

The present invention was made in order to solve the problems in the conventional manufacturing method mentioned above. The primary object of the present invention is to enable the step of finishing the circumferentially marginal edge of the cut pieces to be omitted and the cut piece having a greater area to be employed, whereby productivity can be increased, and the strength as well as durability of the ball can be improved without lowering the performance of the ball to be actually used. The secondary object of the present invention is to provide a method for manufacturing a ball where the cut pieces are mechanically formed and bonding the same to spherical body are mechanically performed, and where productivity, homogeneity of the products and the performance of the ball are significantly improved.

The method for manufacturing a ball of the present invention includes steps of:

expanding a spherical body made of rubber by introducing air within said spherical body; and

bonding a synthetic resin leather cut piece on a surface of said spherical body, wherein said cut piece is mainly made of thermoplastic resin, and wherein said spherical body is covered with said cut piece;

characterized in that said cut piece is three-dimensionally formed along said surface of said spherical body in such a manner as to have a spherical shape by a piece of mold for subjecting said cut piece to heat and pressure, said piece of mold comprising an upper mold and a lower mold, and said cut piece is compressed in such a manner that a thickness of marginal edge of said cut piece increases as a distance from

a circumference of said cut piece becomes longer. By virtue of the feature, the primary object mentioned above is attained. Further, area of the cut piece is at least 2 to 3 times as large as the area of the conventional cut piece, made of synthetic leather sheet only through single step or is bonded on the spherical body using a mold for bonding, whereby the secondary object of the invention mentioned above is attained.

The present invention will be explained with reference to Figs. 3 to 7.

Fig. 3 is a sectional view of the essential parts corresponding to a section taken along lines of A-A of Fig. 2, showing an example of the device for manufacturing the cut piece as shown in Fig. 1 or Fig. 2; Fig. 6 is a sectional view of the essential parts corresponding to a section taken along lines of B-B of Fig. 4 or Fig. 5, showing a device for manufacturing the cut piece as shown in Fig. 4 or Fig. 5; Fig. 7 is perspective view showing an example of a mold for bonding a plurality of the cut pieces on the spherical body at a single step.

In Fig. 3 and Fig. 6, high-frequency electrode lower mold made of metal is denoted by numeral 1, and high-frequency electrode upper mold made of metal is denoted by numeral 2. The upper surface of the lower mold 1 is formed into a spherical convex shaped surface 1a having a substantially identical shape to a part of the inflated spherical body. The lower surface of the upper mold 2 is formed into a recess 2a having spherical surface, in such a manner that a clearance between the spherical convex shaped surface 1a and the recess 2a having spherical surface is substantially identical to a thickness of the synthetic leather under condition where the inner side of the upper mold 2 is contacted

with the lower mold 1. In the outer periphery of the upper mold, there is formed a tapered portion 2b corresponding to the finished part e in Fig. 1. Further in the outer periphery of the tapered portion 2b, engaging portions 2c having a knife like member at the tip thereof are formed in such a manner that the knife like member is contacting with the upper surface of the lower mold 1. Please note the upper mold 2 shown in Fig. 6 serves as an element for obtaining such a cut piece that is divided into a plurality of the cut pieces connected with each other through a pseudo-connecting line f as shown in Figs. 4 or 5, and a protrusion 2d serving as a member for forming a reduced part located along the pseudo-connecting line f is provided on the inner side of the lower surface. According to the device shown in Fig. 3, synthetic resin leather sheet is interposed between the upper and lower molds 1, 2, and high frequency voltage is applied to the upper mold 2 under the condition where the lower mold 1 is grounded so as to give rise to high frequency electric field between the upper and lower molds 1, 2, whereby the cut piece which is three-dimensionally formed to have a spherical shape as shown in Fig. 1 or Fig. 2 can be easily obtained when the synthetic resin leather sheet is compressed, in such a manner that the upper mold is substantially contacted with the lower mold. Likewise, using the upper and lower molds 1, 2 shown in Fig. 6, the cut piece, where a thickness of the circumferentially marginal edge and the pseudo-connecting part f is reduced as shown in Fig. 4 or Fig. 5, can be easily obtained.

In the method for manufacturing the cut piece, the high frequency electrode mold is unlimitedly employed as the upper and lower molds, the heating mold having a heater may be used.

As mentioned above, the cut piece where the thickness of the

periphery of the cut piece is reduced by subjecting to heat and pressure is superior in productivity even if the cut pieces are cut at the same time, when the thickness reduced part is formed. For that reason, the strength in the peripheral part is not lowered. Accordingly, even if the cut piece of the present invention is bonded to the spherical body by the same method as the conventional method, the cost for producing the ball can be lowered and durability can be improved as the effect of the invention. Moreover, the performance of the ball to be actually used is so ideal that the ball produced by the method of the present invention having the advantage of the well-known sewing ball where the cut pieces are sewn to each other on the spherical body as well as the conventional ball where the cut pieces are bonded to the spherical body.

Furthermore, when the cut pieces are three-dimensionally formed to have a spherical shape as shown in Figures, the bonding step can be further easily carried out. The cut piece of present invention has such an area as to largely cover the surface of the spherical body; the cost for producing the ball, the strength of the ball, and the durability of the ball are significantly improved. Further, as shown in Figures, when the cut pieces are cut at the same time when the cut pieces are three-dimensionally formed to have a spherical shape, the outline of the cut piece can be advantageously located along the great circle if the side surfaces of the upper mold 2 for forming the engaging portion 2c having the knife like shape at the tip thereof can be a plane including a center of the spherical surface. Though it is troublesome in the respect where the spherical surface should be formed on the upper mold as well as the lower mold compared with the method where the cut pieces are three-dimensionally formed, the molds are made of copper alloy having a

superior workability. For that reason, the molds therefor are more easily made than the molds for forming the cut pieces where the sides thereof are curved after forming the cut pieces in plane. Furthermore, when the cut pieces are three-dimensionally formed to have a spherical shape, multiple cut pieces can be bonded to the surface of the spherical body at single step using the mold 3 for bonding the cut pieces shown in Fig. 7. The mold 3 for bonding the cut pieces is provided with a recess 3a for accommodating the spherical body. On the inner surface of the recess 3a there is formed a pattern 3b for arranging the cut pieces in place. Accordingly, the cut pieces are arranged on the inner surface of the recess 3a in such a manner as to correspond to the pattern 3b for arranging the cut pieces, adhesive agent is applied to the inner surface of the cut pieces, and the spherical body made of rubber is engaged with the recess 3a, whereby multiple cut pieces can be bonded to the surface of the spherical body at a single step. In that situation, when the peripheral part of the cut pieces having a reduced thickness are not sufficiently bonded to the spherical body, the peripheral part can be easily bonded to the spherical body after removing the spherical body and the pressurizing the peripheral part using a spatula and the like.

As mentioned above, according to the present invention, the ball having superior strength, durability, and superior performance to be actually used can be manufactured with very high productivity. Please note that the synthetic leather is preferably and unlimitedly constructed by forming urethane resin layer on a surface of a substrate as well as within the substrate comprising woven or non-woven fabric made of synthetic fiber (e.g. polyester, nylon).

4. Brief Explanation of the Drawings

Fig. 1 is a cross sectional view of a cut piece to be bonded to a surface of the spherical body made of rubber; Fig. 2 is a plan view; Fig. 3 is a cross sectional view of the essential parts of an example of the apparatus for producing the cut piece made of synthetic resin leather; Figs. 4 and 5 are respectively plan views showing another example of the cut piece made of synthetic resin leather; Fig. 6 is a cross sectional view of another example of the essential parts of the apparatus for producing the cut piece made of synthetic resin leather; and Fig. 7 is a perspective view of an example of a mold for bonding.

1-----lower mold

1a-----spherically convex surface

2-----upper mold

2a-----spherical recess

2b-----tapered portion

2c-----engaging portion

3-----mold for bonding

3a-----recess

3b-----pattern for arranging a cut piece

e-----finished part

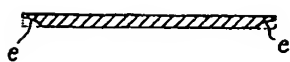
f-----pseudo-connecting part

- 2b ... 勾配部、
 3 ... 貼着型、
 3b ... 裁断片配置模様、
 e ... 殺ぎ削り、
 f ... 見掛け接線線。

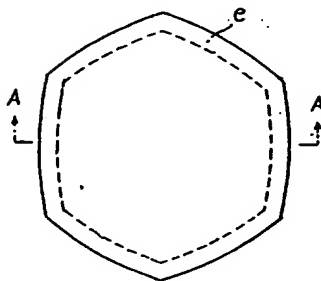
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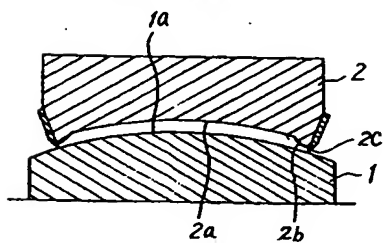
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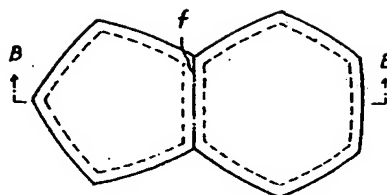
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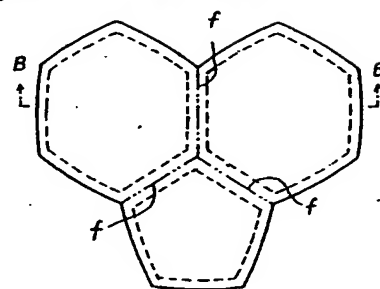
第3図



第4図



第5図



第6図

